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female following her mate with a streaming banner, which proves to be the indispensable snake skin.

Whether this bird, like its little congener, the wood-pewee, has at last concluded that its nest will be more safe near the habitations of man, remains to be seen.



THE REASONING FACULTY OF ANIMALS.

BY JOSEPH F. JAMES.

MUCH as has been written on the subject of instinct and reason in animals, the question as to whether they possess reason is nearly as far from being answered as ever, and people continue to write and argue with the same pertinacity as of yore. Some writers have maintained that all the actions of animals lower than man, are performed by a something designated as instinct, and that this was a faculty given by Divine power to animals, to take the place of reason possessed only by mankind. Others have said that both animals and men have reasoning powers, but the former in such a limited degree as to be hardly noticeable. Still others contended that animals were actuated to a very great extent in their actions by reasoning faculties, and that entirely too much stress has been placed upon the power of instinct;¹ while a last party have said that neither man nor beast is possessed of reason, but that both perform all their actions automatically, and being under the influence of unchangeable law, do what they do because they cannot do otherwise.²

In the olden time, before we knew as much about the animal world as we do now, the unerring faculty of instinct was expatiated upon times without number. All animals were set down as without reasoning powers, and when one did perform an action out of accordance with its usual life, it was looked upon as a most remarkable phenomenon, and as instinct working in an abnormal direction. Besides, this instinct was thought to be bestowed by the Deity, directly upon the animal. In later days

¹The latest book taking this ground is "Mind in the Lower Animals," by W. Lauder Lindsay, 2 vols, 1880.

²Descartes' idea of animated machines. It has for its strongest supporter Professor Huxley. See article "Are Animals Automata?" by T. H. Huxley in *Popular Science Monthly*, v, 724.

this is not so much the case, and many consider that the sooner we discard the idea of instinct, and the sooner we attempt to explain the actions of animals upon the theory of their possessing reason, just that much sooner will we be able to come to a just conclusion.

It can hardly be denied that there are some actions, which, instinctive in the ordinary sense, are transmitted from one generation to another, and are performed by all alike. Let us see if we can not find a reasonable ground for the first introduction of some of these instincts.

There was a time when the first mud wasp stung its first spider or grub, and deposited it in the first nest for the use of its young. But how do we know that this action was performed as successfully by the first female wasp, as it is now by her descendants? Would it not be just as reasonable to suppose that the present perfection of this action, if it be perfect, was the result of long experience, and of a gradual improvement from generation to generation, as to imagine that the first wasp succeeded as well as her descendants do now? There was a time when the first chicken was hatched and scratched the ground. But is it necessary to suppose that the first born of the jungle-fowl of India acted as our barnyard fowls do now, to account for the ability of the new born chicks to run over and scratch the ground? Not so. These actions, and perhaps many more, are hereditary faculties, imperfect and crude at first, but gradually improving and perfecting, and transmitted from generation to generation in the same way as a taste for engineering, a liking for science, or ambition to be a soldier, descends from father to son. The gradual development of the mind of animals and of man, is under the influence of the same laws as the development of the body.

It is probable that the first pair of jungle-fowls of India, way back in antediluvian times, hatched a brood of young ones, which stayed in the nest till fully fledged, as do the young of most all birds. Suppose an accidental event occurred, which made it advantageous for the young chick to be able to run and scratch as soon as it broke out of the shell. Suppose it was found by nature, that the chick that could run away soonest after being born, would be the one most likely to escape from the clutches of the hawk when the mother was driven from the nest. The additional safeguard of life would be seized upon, and by

gradually strengthening the ability to run, it would be transmitted in an improved form through the birds which escaped by running, to their descendants, and finally be bequeathed to their posterity in the form in which we now find it. Such an explanation would apply to quail and grouse, and, in fact, to all birds which run as soon as hatched, and seek to hide themselves from their enemies in the grass and bushes. This instinct in young chickens is by no means so perfect as it might be; for any one who has noticed them when just hatched, and led by the hen, will have seen that they stumble and stagger, sometimes going head over heels in their efforts to pick something up. So that even if it were instinct, it is perfected by practice.

Then again with the wasp. The one which provided best for its offspring, would leave the most descendants; and the faculty and the ability to provide would be transmitted from generation to generation, being improved each time by the natural laws of modification with descent, and by the struggle for existence. So with the cells of the bee. Mathematicians have been struck with astonishment, and held up their hands in holy wonder, to see such an insignificant insect as a bee making a cell more mathematically accurate than they can after a lapse of 2000 years.¹ But it was a matter of necessity to use as little material and occupy as little space as possible with his cells. The ancient bees doubtless made their cells much less mathematically correct than the present ones are supposed to do.² And it was only when the use of less wax, and of less space, gave one hive the advantage over another in the struggle for existence, that the present cell began to appear. It was not made so because of the instinct of the bee, but because the laws of nature compelled it to be made so, if the bee would hold its own in the struggle. We know well that bees do not make their cells always exactly alike, nor as exactly hexagonal as we are often told. They depart from the regular shape,³ and use other forms to suit circumstances, and we have here a

¹ Lord Brougham, "Dialogues on Instinct," 1844, pp. 66-70.

² Even the cells of the present hive bee are by no means perfect. In fact, investigations by Professor Wyman, printed in the Proceedings of American Academy of Arts and Sciences, VII, 1866, have proved "that the cells are all more or less imperfect, and that an hexagonal cell, mathematically exact, does not exist in nature, but only in theory." Packard, "Guide to Study of Insects," 1869, pp. 123-127, which see for an extended notice of Professor Wyman's paper.

³ See Kirby and Spence, "Introduction to Entomology." Lond. ed. II, 469.

clear evidence of reasoning powers, and of the faculty of adapting means to ends.

Again we are told that many insects lay their eggs upon the leaves of certain plants, upon which the larvæ feed, and upon no others, and it is pointed out as a case in which the Almighty has endowed the creature with an instinctive knowledge of the plant. But why should it be so? The white butterfly lays its eggs upon the cabbage, and the larvæ feed upon its leaves. What right have we to say that the butterfly does not know the cabbage? There may be something about that plant agreeable to her olfactory nerves, which induces her to alight and deposit her eggs. Or it may be that in ancient days, and must have been, that the butterfly deposited her eggs upon any plant indiscriminately. If those that fed upon the cabbage thrived better than those on some other plant, they would be preserved in the struggle for existence, and leaving more descendants than their rivals, would thus transmit the habit of frequenting more and more the cabbage plant. Perhaps at the time some species of insects originated, the ancestor of all deposited her eggs upon any plant most convenient. All may not have been suitable, but the larvæ thrived on those that were, and frequented the same plant afterwards; and thus in feeding on different plants and leading different lives, the one original species became differentiated into distinct but allied species.

The instinct which induces the cuckoo to lay her eggs in the nests of other birds, can be shown to have arisen in much the same manner as those to which we have referred. Mr. Darwin gives an excellent account of how the instinct might be developed. He says: "Now let us suppose that the ancient progenitor of the European cuckoo, had the habits of the American cuckoo, and that she occasionally laid an egg in another bird's nest. If the old bird profited by this occasional habit through being able to migrate earlier, or through any other cause; or if the young were made more vigorous by advantage being taken of the mistaken instinct of another species, than when reared by their own mother, encumbered as she could hardly fail to be by having eggs and young of different ages at the same time; then the old birds or the fostered young ones would gain an advantage. And analogy would lead us to believe, that the young thus reared, would be apt to follow by inheritance the occasional and abber-

rant habits of their mother, and in their turn would be apt to lay their eggs in other birds' nests, and thus be more successful in rearing their young."¹ This explanation seems to us simple, and at the same time adequate, and the same process of reasoning applied to all instincts of like character, would with little modification be sufficient. Such instincts as the last, the hive bee cells, the case of butterflies laying eggs on plants, the slave-making habits of ants, and many more which will recur to any one, are brought into existence accidentally, and given a tendency to variation in any faculty of the mind or power of the body, and we can expect to see it modified by nature's seizing upon the favorable variations, transmitting them in an improved state each time by inheritance from one generation to another, until they reach such perfection that men are astonished, and can see no other way of accounting for the fact, but by bringing to their aid divine power and intervention.

Now we are told, that instinct is some power or principle possessed by animals, by means of which they perform, blindly and ignorantly, works of an intelligent nature; further, an impulse by which they are directed, without previous instruction or experience, to do unerringly what is necessary for the preservation of the individual or the species. The fact that instincts are not unerring, goes far to prove that they had some such origin as we have described. It is known, for instance, that butterflies and moths often lay their eggs upon plants or in positions where their larvæ can not flourish.² What is this but a return to a former method of proceeding, when the insect laid her eggs on any plant? Here the instinct fails utterly, and not only does not assist in the preservation of the species, but is instrumental in destroying it. Cattle are supposed to know by instinct poisonous from beneficial plants, but take them to a new country, and they at first are as likely to eat the poisonous ones as those that are not. Their so-called instinct fails, because it is not an instinct at all, but the result of experience and observation. The instinctive dread birds have of man is often spoken of; but that is no instinct either. Birds and animals of all kinds in a state of nature, where

¹ Origin of Species, 6th ed., N. Y., p. 212.

² Kirby and Spence, loc. cit. II, 466, say that the flesh fly sometimes lays her eggs in the flowers of *Stapelia hirsuta*, instead of in carrion, and further that the common house fly will frequently deposit her eggs in the snuff in a box.

they have never been molested, or disturbed but little, have no great dread of man, and it is only after they have learned by dire experience, and by observation, the evils likely to fall upon them from the advent of man, that they show any dread or fear of him.¹ This dread is then transmitted to their offspring, but is by no means an inherent faculty of the birds' or animals' mind.

It is said again that a marked instinct is shown in birds by their nest building. Some say the bird makes as good a nest the first time she tries, as when she becomes old and experienced. But this has been emphatically denied, and is doubtless untrue. An observer has given an account of the first and subsequent attempts of one pair of birds to build a nest; and he shows conclusively that the first was a poor specimen of bird architecture, the second was an improvement, the third still better, and so on until the art was finally reached of making a handsome and serviceable nest. Alexander Wilson, one of the best of ornithologists, believed implicitly that birds improve in nest building and gives several instances of it.² Birds learn to sing, too, by a long apprenticeship. At first the song consists merely of a few disconnected notes. By continual practice the art is developed, and at last the bird carols forth the lay which delights all hearers.³ It is not the result of instinct, but of practice and gradual improvement. Mr. Wallace believes that as man performs many of his intelligent acts merely by imitation, so it is with birds in making a nest.⁴

One would think that if there is any action which is instinctive with water animals, it would be that of swimming, yet this is not always the case. A writer in *Harper's Weekly* stated that "were a young seal taken three or four weeks after birth and thrown into

¹ See Darwin's *Voyage of Naturalist*, pp. 398-401. In speaking of the birds of the Galapagos islands, he says: "A gun is here almost superfluous, for with the muzzle I pushed a hawk off the branch of a tree. One day whilst lying down, a mocking thrush alighted on the edge of a pitcher, made of the shell of a tortoise, which I held in my hand, and began very quietly to sip the water; it allowed me to lift it from the ground whilst seated on the vessel." The testimony of other travelers is corroborative.

² *American Ornithology* (16mo, Edinburgh edition, 4 vols. 1831), I, 179, 189-190. See also article by Dr. Brewer, "On Variation of the nests of the same species of Birds." *AM. NAT.* XII, 35. Wallace, "Contributions to Natural Selection," p. 227. Article from "Revue des Deux Mondes" in *Pop. Sci Monthly*, II, 485, and others.

³ Darwin's "Descent of Man," 1st. ed., I, 53 and 54. Wallace, *ibid.*, p. 220, et seq.

⁴ Wallace, *ibid.* "Essay on Philosophy of Birds' Nests."

deep water, it would drown miserably in a few minutes; they begin to grow accustomed to the water at the end of three or four months by degrees, and it takes a pup about three weeks' practice at the surf margin before it can handle its flippers properly in the water." Here instinct is out of the question, for to be that, the ability to swim would be manifested almost at birth.

We have granted that some animals are possessed of instincts, but we deny that these are implanted by divine agency, and contend that they come into existence in obedience to natural laws. We contend also that outside of these instincts proper, animals of all classes, from insects¹ up to monkeys, perform acts which are certainly analogous to those performed by the human mind, and which ought to rank with the reason of man. Reason, we are told, is the power by means of which one proposition is deduced from another, and of forming a conclusion from known premises. Now if it could be proved that animals are possessed of feelings of love, hate, jealousy, grief, kindness, memory, and many other human traits; that they can distinguish right from wrong; if it could be proved that they are capable of drawing conclusions from known premises; and that they can and do follow out a train of reasoning; then it would be proved beyond all peradventure that they do have reason, and to a very marked degree.

There are thousands of anecdotes relating to all classes of the animal kingdom showing in a greater or less degree the reasoning faculty. It is obviously impossible to give anything like all of them here, and a few of the more striking and relating to the principal classes, will serve to point our moral and adorn our tale.

Of the Articulates, the Crustacea are considered low in the scale, yet instances showing reason are recorded of them. Darwin² tells us of a shore crab seen in Brazil by Mr. Gardiner. The animal was making its burrow in the sand, and Mr. G. threw some shells toward it. One of them rolled in, and three others lodged on the edge. The crab in about five minutes, brought out the shell, and carried it off about a foot and dropped it. Returning

¹ Lindsay in his "Mind in the Lower Animals" says that even in the Protozoa we find manifestations of purpose. That, in fact, all the orders of the Invertebrata are possessed of intelligence, foresight and reason to a greater or less extent. This is especially the case with ants. I, pp. 52-68.

² Descent of Man, 1st ed., I, 325.

and seeing the three other shells near the edge of his burrow, and apparently thinking that they too might roll in, he carried them off one by one, and deposited them with the other. Did not this animal reason on the subject in the same manner as a man would? Most decidedly so. Hermit crabs have been seen to rob one another of their shells. A big one was once seen to give chase to a little crab with a shell much larger than his own. "The little one, apparently quite alive to the sinister intentions of his pursuer, took to flight as quickly as possible, and his attempts to escape were continued with the utmost vigor until further effort was hopeless. * * * At length he was overtaken, and then a regular pitched battle ensued. The little one resisted manfully, but was finally overcome, the more bulky opponent having, after the most strenuous exertions, succeeded in forcing his claws between the body of his weaker opponent, and his shell, and with the most frantic exertion turning him out. They then, apparently as a matter of course, exchanged shells, the ousted tenant yielding submissively to his fate, and quietly adapting himself to his reduced circumstances."¹ Suppose a man with boots too small for him, saw a little man with boots much larger than his own. Suppose society in such a state as to allow the big man to rob the little one of his boots, and leave his own for the use of the other. Would the man act by reason or by instinct? The answer is obvious.

Insects are higher than crabs in the animal creation, and among them we find the best developed instincts with a high degree of reasoning. Take for instance the ants. They live in communities, and some obey while others command; some work while others direct, so they must have a method of communicating ideas;² they recognize their comrades after being separated from them for months,³ and therefore have memory; and language and memory are two of the highest gifts of man's mental nature. Bees can distinguish one kind of flower from another;⁴ they bite holes in the base of the corolla to get at the honey when it is too

¹ Wood's "Man and Beast." N. Y., 8vo ed., p. 95.

² Sir J. Lubbock in *AM. NAT.*, x, 156, et seq. Also note in *Pop. Sci. Mon.*, ix, p. 252. Article on "Habits of Ants" in *Pop. Science*, xi, 39.

³ Huber, "Recherches sur les Fourmes," quoted in Kirby and Spence, l. c., ii, 66. Lubbock, *ibid*, x, 154.

⁴ Darwin, "Cross and Self Fertilization in Vegetable Kingdom," p. 416.

far for them to reach from the top, and when the hole is once bitten will always seek it;¹ thus one individual takes advantage of the labor of another. They can alter the shape of the cells of their hive to suit circumstances.² They are compelled to learn how to distinguish the situation of their hive when moved to a new place by circling round and round in the air and taking mental notes of its position;³ and it is only after observation, experience and practice, that they can fly directly to the entrance. Wasps learn the position of their nests in the same manner. They are capable of being tamed and of recognizing their masters,⁴ as are also butterflies. In districts where some species of dung beetles are found, they have the habit of depositing eggs in pellets made of horse or cow manure; but in districts where sheep are kept, instead of making the pellets, the insects use the pellet shaped excrement of these animals.⁵ Beetles assist one another in their work and communicate ideas.⁶

If it seems unreasonable to say that an insect, without any distinct brain and nothing but a system of ganglia, can reason in such a manner, we might ask, what do you know about the mental powers of insects? How can we gauge their sight and compare it with ours, when their eyes have often hundreds of facets?⁷ Or know aught of their feelings when we know that some feel with their antennæ?⁸ Or anything about their hearing, when some hear with their antennæ, some with their fore legs, and some with their wings?⁹ We don't know anything about it, and perhaps never will.

Many stories are told of the actions of toads. They can be easily tamed, will feed out of one's hand, and come at a call. Here is an anecdote of one. A lady was sitting in a garden,

¹ Huber, Linn. Trans., VI, 222, quoted by Kirby and Spence, l. c., II, 516. Darwin, *ibid*, pp. 426, et seq.

² Kirby and Spence, l. c., II, 475-489.

³ Huber, *Recherches*, p. 100, quoted by Kirby and Spence, l. c., II, p. 520.

⁴ Sir John Lubbock's tame wasp has become historical.

⁵ Kirby and Spence, loc. cit., II, 469, quoted from Sturm's *Deutschland's Fauna*, I, 27.

⁶ Kirby and Spence, loc. cit., II, 519, quoted from *Illiger's Mag.*, I, 488.

⁷ "The number of facets or corneæ vary from 50 (in the ant) to 3650, the latter number being counted by Geoffroy in the eye of a butterfly." Packard, l. c., p. 25.

⁸ Packard, loc. cit., p. 26.

⁹ Wallace, *Contributions*, loc. cit., p. 202.

when she saw a large toad moving along the base of a wall, and examining it most systematically. He raised himself on his hind legs, peered into a crevice first with one eye and then with the other, and pushed his paw into the aperture. Apparently dissatisfied, he continued his operations and examined another, and then a third. This last seemed to satisfy him, and slowly drawing himself up he disappeared into the crevice. He evidently knew his own size and selected a hole big enough to crawl into without effort.¹ All fishermen know how difficult it is to induce an old trout to take the fly, and when hooked how successful he often is in tangling the line, or snapping it off against roots or stones. He has gained by long experience a knowledge of the traps set for him by man, and uses his knowledge in keeping out of the snares, and breaking away when caught. He has sense enough to know the danger he is in, and reason enough to keep out of it.

In respect to the reasoning powers of birds, there are so many anecdotes that it is difficult to make a selection. Every one knows how easily many birds are tamed; the crow or raven for instance, and above all the parrot, and how cunning they are in hiding any article they wish to keep to themselves. Swallows know that the hawk is their enemy, and sometimes take great delight in pestering him. Dashing forward as if immediately into his claws, then suddenly swerving off and enjoying the discomfiture of their enemy, who thought to have a feast. A swallow had become entangled by the leg with a string. His cries attracted some companions, and after a consultation they conceived a method of releasing the captive. They commenced to fly past the bird one after the other, each pecking at a certain point on the string as he passed, until it was cut in two, and the bird freed from bondage. A story is told of a goose and a hen. The latter hatched out some duck eggs, and of course the ducklings wished to take immediately to the water. The hen objected seriously, but without avail, and while she was mourning over the obstinacy of her brood, a solitary goose swam up, and with a noisy gabble took charge of them. After piloting them up and down for a while, they were turned over to their foster mother. Next day the same scene was repeated. This time the goose came close up to the bank, and without further parley the hen jumped on her

¹ Wood, *Man and Beast*, loc. cit., p. 23.

back and sailed about while the ducklings were enjoying their swim. This took place day after day, until the ducks were large enough to take care of themselves.¹ A gentleman busily at work in his garden had his attention attracted by a robin, who was acting in a curious manner. Feeling some curiosity to know what was the cause, he followed the bird and was led directly to her nest. There he saw a black snake which was in the act of robbing the nest. After the snake was killed, the bird showed great joy; flew down and pecked at the dead animal with every appearance of hatred, and then lighted on the gentleman's arm and poured forth her delight and gratitude in song.

With respect to mammals, it is hardly possible to see how any body can deny that they often reason. Who can not think of instances of the intelligence of dogs? or of a horse? or of the elephant? A very few anecdotes must here suffice. A retriever was observed by a workman busily collecting grass and leaves and carrying them in his mouth to one place. On examining the spot he found a hedgehog closely rolled up. When the dog had collected a sufficient quantity of grass to prevent the spines wounding him, he took the bunch in his mouth and trotted off. Darwin² tells a story of another retriever which most conclusively shows reason. "Mr. Colquhoun winged two wild ducks, which fell on the opposite side of a stream. His retriever tried to bring over both at once, but could not succeed; she then, though never before known to ruffle a feather, deliberately killed one, brought over the other, and returned for the dead bird." He also quotes Rengger in regard to American monkeys. Rengger states, "that when he first gave eggs to his monkeys, they smashed them, thus losing much of their contents; afterward they gently hit one end against some hard body and picked off the bits of shell with their fingers. After cutting themselves only once with any sharp tool, they would not touch it again, or would handle it with the greatest care. Lumps of sugar were often given them wrapped up in paper, and Rengger sometimes put a live wasp in the paper, so that in hastily unfolding it they got stung; after this had once happened, they always first held the packet to their ears to detect any movement within."³ A baboon in London had the habit of

¹ Wood, *Man and Beast*, loc. cit., p. 49.

² *Descent of Man*, 1st ed., I, p. 46.

³ *Descent of Man*, 1st ed., I, 45, 46.

adopting animals. Once a young kitten scratched him. He was astonished and looking at the kitten's paws, immediately bit off the claws. Animals, monkeys especially, use sticks and stones as instruments and weapons. A party of baboons in Africa were attacked by men at the entrance of a narrow pass in the mountains. The animals were up on the mountain side, and rolled the stones down into the pass so thick and fast that for a time it was completely blockaded. The orang in Borneo knows how to handle and throw sticks in the same manner, and even makes himself a bed in the tree to sleep at night, covering his head with leaves.¹ Humboldt refers to the horses and mules used in crossing the Andes. "Thus the mountaineers are heard to say, 'I will not give you the mule whose step is the easiest, but the one which has the most intelligence.'"²

It is hardly possible in the limits of an article like this, to do justice to our subject, but we are sure that what little has been said, will show to a fair and impartial reader, that animals certainly do possess a large amount of reason. There may be those who prefer to think that instincts are given to animals in a perfect form, by the Almighty. These seem to think that in taking the matter out of the Creator's hands directly, and placing all animal life under the control of natural laws, that we thereby detract from His power. But not so. For He made the laws by means of which animal life has progressed on the globe, and after the establishment of these laws, He holds Himself aloof from interfering. It is more degrading to the grandeur of the Infinite to suppose He has been compelled to interfere constantly with the works of His hands, than to suppose that He has, in the first place, established laws immutable and unchangeable, and endowed the first germs of life with the possibilities which have led to such grand results as are visible in the animal kingdom.

¹ Wallace, Malay Archipelago, N. Y. ed., p. 52, 70.

² Travels in Equatorial Regions of South America, I, 249.